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DEPARTMENT OF NOTES, REVIEWS, ETC.

It is the purpose, in this department, to present from time to time brief original notes, both of methods of work and of results, by members of the Society. All members are invited to submit such items. In the absence of these there will be given a few brief abstracts of recent work of more general interest to students and teachers. There will be no attempt to make these abstracts exhaustive. They will illustrate progress without attempting to define it, and will thus give to the teacher current illustrations, and to the isolated student suggestions of suitable fields of investigation.—[Editor.]

AN APPARATUS FOR GRADUAL DEHYDRATION

In working with delicate tissues, the more gradual the exchange of fluids the less likely are osmotic distortions to occur. The apparatus here described was devised to bring about an exchange of fluids using the minimum amounts, without abrupt transitional changes, while at the same time controlling the rate of change from one density to another.

In Figure 1, an outer tube (a) carrying a small bulb below it, receives an inner tube (b) fitting the outer rather closely for some distance from the top, and tapering below to a capillary of about 1mm. diameter. This capillary (c) is recurved at the end to prevent back-flow. The bulb (f) and the stem below it are packed with cotton or other porous material to insure mixing of fluids passing thru. A short length of rubber tubing (g) connects the stem below the bulb with a glass tube (h) drawn out to a capillary point, and thrust into the tubing point upward. The size of the capillary opening of this tip determines the rate of flow. Its insertion into the tubing point upward renders clogging improbable, and eliminates any resistance that capillary action in this end-piece might occasion. A container for tissues (i) with its overflow (k) completes the apparatus. The whole is supported by two clamps on a ringstand, one holding the tube (a) the other the container (i). The overflow is caught in a waste receptacle below.

Let us suppose we wish to pass bits of tissue from 50 to 95% alcohol. A series of pieces suspended on a thread or placed between loose plugs of cotton are held in a container (i) of minimum length and diameter that will accommodate them. The smaller the

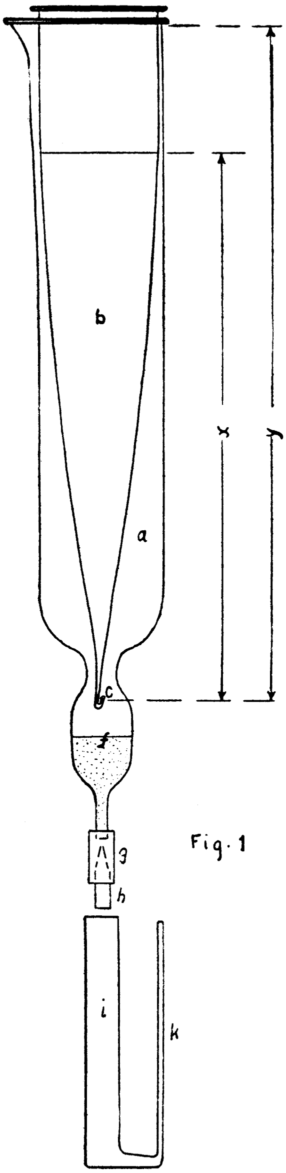

Fig. 1

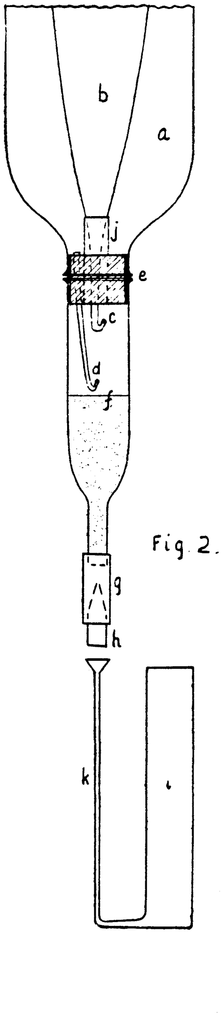

Fig. 2.

Dehydration Apparatus

diameter of the container the faster will the current of alcohol move past the tissues, and the more quickly remove waste products soaked from them. A plug on the end of a wire is inserted from the top of the apparatus into the taper near the bottom of (b), and 50% alcohol is poured in. Enough should be allowed to flow past the plug, (by raising it slightly) to fill the bulb (f) up to the bottom of the outer tube. Ninety-five per cent alcohol is then poured into the outer tube at the lip on its upper edge, until full. The amount of 50% placed in the inner tube should be a very little more than enough to balance the column outside, since the two are to be in equilibrium during operation. This amount may be ascertained by trial or by computation, and indicated by a scratch on the glass. It may be computed by figuring the height of a column of 50% alcohol in the inner tube that will balance the outer tube filled full. Let this height be represented by (y), that of the inner column by (x). If X is the density of 50% alcohol and Y of 95%, then $xX=yY$, and $x=\frac{X}{Y}y$. If a little more than enough to balance is placed in the inner tube it will do no harm, as it will flow thru the capillary and remain beneath the lighter fluid. If the other flows back however it rises thru the heavier liquid and contaminates it, and further disturbs the equilibrium by rendering the column of fluid thru the capillary too light.

The first fluid issuing from the apparatus will be pure 50% alcohol from the mixing bulb. As the liquid is drawn off, and the levels of the two containers lower, (the two columns remaining in equilibrium,) the proportion of the heavier alcohol drawn from the inner tube will decrease from 100% to 0, while the proportion of lighter alcohol drawn from the outer tube will increase from 0 to 100%. The resultant liquid dropping into the container after being mixed in the cotton packed bulb will consist of a perfectly graduated column of alcohol varying from 50% to 95%, which will move slowly past any tissues that may be suspended in the container. After the apparatus has run dry, a little more 95% alcohol dripped thru will force the graduated column, or the last end of it, past the tissues, and leave them in pure 95%. Without removing from the container they may be put thru further changes with other fluids.

To pass tissues from a higher to a lower alcohol, or from a light to a dense fluid in general, requires a modification of this apparatus. If the heavy fluid were placed in the outer tube, to reverse the process as described above, the content of the inner tube, as it proceeded from the capillary opening, would rise thru the heavier liquid without mixing. One of two methods can be employed to prevent this. Either the taper can be blown in the opposite direction, large and tight fitting at the bottom and small at the top; or the method of delivering the two fluids into the mixing chamber may be modified.

Figure 2 shows the apparatus with a cork (e) fitted into the neck between tube and mixing bulb. A piece of rubber tubing (j) is fitted thru the center of the cork, and a recurved capillary tube (d) thru one side of the center. For greater facility in cleaning, replacement of parts, and construction or readjustment of the apparatus the outer tube (a) and the mixing bulb (f) can be made separate and held together by inserting the cork into the end of each. The ideal construction would by a ground joint such that the upper part would fit into the lower as a ground glass stopper fits a bottle; the cork being first inserted into the bottom of the upper section. The lighter liquid is placed in the inner tube, which fits tightly into the rubber tubing thru the cork. Enough is allowed to run thru into the bulb to fill this as before. The outside tube is filled with the heavy liquid, to a height to balance the inner column. The tubes are made to fit tightly for some distance from the top, and the taper of the inside tube should begin at the level to which, when the apparatus is used to pass from lighter to denser fluids, it will be necessary to fill the outer tube. (This will not hinder its operation in the reverse process.) The tissue holder must be reversed so that the flow is in thru the smaller arm and out at the top of (i). This arm (k) should not be more than a millimeter or two in diameter.

The contents of the mixing chamber, being of the lighter fluid, may come down after the upper part of the apparatus is exhausted, and contaminate the tissues again. Either the apparatus must be watched, or the arm (k) made so little higher than the container that when the arm fills with the lighter liquid it will overflow before it forces any of the lighter liquid to the inlet at the bottom. When the apparatus is empty a little more of the heavy fluid dripped thru as in the former operation will replace the last of the column of mixed fluids.

Several points should be noted in the construction of the apparatus.

The inner tapering tube is not blown as a straight cone, but flares at the middle. The curve of its side may be computed simply. Let D be the diameter of the tube at the wide top. The volume of a short section of the tube at that region is D^2 times a constant. If volumes of such sections are to be made to decrease equably from top to bottom, to obtain a change in the relative amounts of the two liquids proportional to the time of operation, the diameters corresponding to these decreasing volumes in the inner tube must decrease as the square root of the volumes. So the diameter half way down must be the square root of $\frac{D^2}{2}$; that ¾ of the way down the square root of $\frac{D^2}{4}$; that ¼, the square root of $\frac{3\,D^2}{4}$, and so forth. For practical purposes the volume of the glass itself may be disregarded.

Unless the point of this tapering tube is recurved, to form a sort of trap, (also that of the capillary tube (d) thrust thru the cork at (e),) the lighter liquid will diffuse upward thru the capillary containing the heavier as soon as the flow thru the latter becomes slow.

If the tubes fit too tightly at the top, surface tension between them may result in an interference with the balance between the two fluids. This can be obviated by blowing the outer tube with a channel running from the lip provided for filling down the side to a distance beyond the beginning of the taper of the inner tube.

A number of different capillary tips to fit into the rubber tubing at (g) may be provided, and the flow regulated by a choice of tips, or a clogged tip replaced. While the tip is being removed the flow can be stopped by pinching the tubing between the fingers. Other devices for controlling flow, such as pinch cock, stop cocks, etc., were tried, but none is so satisfactory as the inverted capillary.

No mention has been made of size, because the varying needs of the user determine this. Several would be needed for any general work. One now in use, holding 500cc., empties in five to six hours, dropping alcohol, at the rate of 50 drops per minute. This is very rapid, and the same apparatus can be made to run ten to twelve hours at least. Another containing 40cc. runs two hours, dropping at the rate of five drops per minute.

The tubes (a) and (b) must not be too long in proportion to diameter and desired flow, since the taller the apparatus the greater the difference in pressure between start and finish, which means a difference in rate of flow correspondingly, (tho not proportionally) great. A proportion of length to diameter of 3 to 1 has been found most practical. A broader one is disturbed by jarring of the apparatus, and a taller one varies considerable in rate. The mixing chamber should be at least an inch long, better an inch and a half, but may be of small diameter.

If the fluids should be imperfectly mixed when they issue from the apparatus, the unmixed portions will almost immediately arrange themselves in the container and no harm result. With a properly packed mixing chamber 95% alcohol and water may be so mixed that the resultant fluid shows no diffusion currents in the container. It has usually been found desirable however to use two fluids nearer together in density, as water and 50% alcohol, then 50% alcohol with 95% alcohol, then 95 and 100% alcohol, then 100% and a mixture of half 100% and half xylol or other oil, etc. The result is greater certainty and better efficiency in the use of the apparatus.

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AN INDIVIDUAL PARAFFIN BATH

An improved form of the Self-Regulating Paraffin Bath as designed by C. W. Woodruff, and described in the Journal of the Royal Microscopical Society for October of 1914, has been in use in the Animal Biology Laboratories at the State University of Iowa for nearly three years.

The original apparatus was made of tin, but as tin rusted so quickly other materials have been substituted. So, now the apparatus consists of a glass double cup blown in one piece, one cup be-